

# NCEI v2.0 trajectory Example netCDF File Testing Report

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This document provides a brief summary of using the NCEI netCDF templates v2.0 in various online compliance checkers, software packages, and web services. The intention of this report is to provide further detail concerning the various messages a netCDF file would receive if it was in complete compliance with the NCEI netCDF templates v2.0 for the trajectory featureType. In addition, the example data files have been imported into various software packages (Matlab, Python, and ODV) to document any inconsistencies when ingesting and plotting the data points. The commands used to import and plot the data in the software packages have also been included.

The data files used in this report can be found at:

<http://data.nodc.noaa.gov/ncei/example/data/netcdf/v2.0/>

and in the THREDDS catalog:

<http://data.nodc.noaa.gov/thredds/catalog/example/v2.0/catalog.html>

## Version control

Version	Date	Author	Comments
0.9	2016-09-30	M. Biddle	Initial draft of documentation.
1.0	2016-10-11	M. Biddle	Updated documentation with feedback from NCEI netCDF working group.



Below is an outline of how this document is constructed:

**Template Feature Type:** (the feature type used in testing, hyperlink to file)

**Checker:** (compliance checker where the issue arose, hyperlink to checker)

Specific check: (includes score and date the check was ran on)

- **Issue #1:**
  - Possible resolution
- **Issue #2:**
  - Possible resolution

Specific check:

- **Issue #1:**
  - Possible resolution
- **Issue #2:**
  - Possible resolution

**Checker:**

Specific check:

- **Issue #1:**
  - Possible resolution
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Specific check:

- **Issue #1:**
  - Possible resolution
- **Issue #2:**
  - Possible resolution

**Access Site:** (the access site used for the protocols below, e.g. THREDDS)

Protocol: (the access protocol tested, e.g. OPeNDAP Dataset Access Form)

- Result of test

Protocol:

- Result of test

**Software Package:** (name of software package, e.g. Matlab)

- **Opening/Importing the file.**
  - Result of the test, including code.
- **Plotting the data**
  - Result of test, including code and plots.

## trajectory:

### IOOS Compliance Checker:

CF 1.6 (154/160) ran on 09/19/2016:

- **Cell\_methods\_name: The name field does not match a dimension, area or coordinate.**
  - The contents of the cell\_methods attribute should be "lon: point lat: point" instead of "longitude: point latitude: point".
  - CF 1.6 section 7.3.4 states that it is fine for a cell method to reference a standard name (such as longitude) even though there is no coordinate designated as longitude, but it does not allow for naming a dimension. It also allows for using the name 'area', but it forbids using a standard name or 'area' if that name corresponds to a scalar coordinate variable name or a dimension name that doesn't have a corresponding 1D coordinate variable of the same name.
  - The ability to use a standard name is important for cases where each cell represents an integral over a coordinate that is not present in the file, such as Hovmöller diagram grids (time vs latitude or longitude).
- **The variable instrument1 does not have associated coordinates**
  - Expected, as the instrument variable doesn't need to have coordinates.
- **The variable platform1 does not have associated coordinates**
  - Expected as the platform variable doesn't need to have coordinates.

ACDD 1.3 (100/107) ran on 09/19/2016:

- **Neither 'acknowledgment' nor 'acknowledgement' attributes present**
  - Ignore. File contains "acknowledgement"
  - This is an error in the checker and has been changed, it has yet to be published in the web checker (<https://github.com/ioos/compliance-checker/pull/262>).
- **Var instrument1 missing attr standard\_name and units**
  - Ignore, instrument1 doesn't need units or standard\_name attributes.
  - There is no requirement for any variable to have a standard name. If the quantity being measured doesn't have one it doesn't have one. This should be treated as informational.
- **Var platform1 missing attr standard\_name and units**
  - Ignore, platform1 doesn't need units or standard\_name attributes.
  - There is no requirement for any variable to have a standard name. If the quantity being measured doesn't have one it doesn't have one. This should be treated as informational.
- **Var trajectory missing attr coverage\_content\_type, standard\_name, and units**
  - Expected error, station variable doesn't need to have coverage\_content\_type, standard\_name and units.

NCEI Trajectory 1.1 (122/127) ran on 09/19/2016:

- **nodc\_template\_version attribute must be NODC\_NetCDF\_Trajectory\_Template\_v1.1**

- This is an expected error, the file contains NCEI\_NetCDF\_Trajectory\_Template\_v2.0 in the nodc\_template\_version attribute which is in compliance with current practices.
- **Conventions attribute is missing or is not equal to CF-1.6: CF-1.6, ACDD-1.3**
  - This is an expected error, current conventions allow for multiple conventions attributes.
  - This is a problem in the checker and is currently being revisited, see <https://github.com/ioos/compliance-checker/milestone/8> for more information.
- **Metadata\_Conventions attribute is required to be 'Unidata Dataset Discovery v1.0'**
  - This is an expected error, ACDD 1.3 changed the recommendation for this attribute.
- **platform should exist and point to a variable.**
  - This is an expected error, platform now contains ACDD representation of the platform.
- **sea\_name attribute should exist and should be from the NODC sea names list: Cordell Bank National Marine Sanctuary is not a valid sea name**
  - Checker is looking at [https://github.com/lukecampbell/cc-plugin-ncei/blob/base/cc\\_plugin\\_ncei/data/seanames.csv](https://github.com/lukecampbell/cc-plugin-ncei/blob/base/cc_plugin_ncei/data/seanames.csv) for seanames. it only includes those with IHB codes. Thus, it will never include "Coastal Waters" or "Marine Sanctuaries"
  - The problem has been reported at <https://github.com/ioos/cc-plugin-ncei/issues/8> and is being investigated. This check can be ignored.

## [Jet Propulsion Laboratory Metadata Compliance Checker:](#)

### ACDD 1.3 Checker (112/147):

- **“There was a problem downloading your file. The server may be too busy or the file may not exist. URL: [http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI\\_trajectory\\_template\\_v2.0\\_2016-09-22\\_181611.149250.nc](http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc)”**
  - Issue with the checker using OPeNDAP links.
  - Downloading the file and testing against that file works.
  - Bug with the checker.
- **check for a comma separated value failed because "keywords" might not be comma separated**
  - Ignore as keywords is comma separated, “keywords: Oceans > Ocean Temperature > Water Temperature, Oceans > Salinity/Density > Salinity”
  - The list in the keywords attribute uses the GCMD convention for describing keywords, to find more information about GCMD keywords, see <http://gcmd.nasa.gov/learn/keywords.html>.
- **check for a comma separated value failed because "Conventions" might not be comma separated**
  - Ignore as conventions is comma separated, “Conventions: CF-1.6, ACDD-1.3”
- **check for existence failed because "crs:long\_name" does not exist**
  - Ignore because crs is not required to have long\_name attribute.
- **standard\_name 12 out of 20 passed**
  - Not all variables require a standard\_name attribute, in this case instrument1, platform1, and crs are not required to have standard\_name attributes. So the standard\_name checks are not required for those variables.

- **units 12 out of 20 passed**
  - Not all variables require a units attribute, in this case instrument1, platform1, and crs are not required to have units attributes. So the units checks are not required for those variables.
- **coverage\_content\_type 4 out of 20 passed**
  - Not all variables require a coverage\_content\_type attribute, in this case instrument1, platform1, crs, z, time, lat, and lon are not required to have content\_coverage\_type attributes. So the content\_coverage\_type checks are not required for those variables. Content\_coverage\_type only applies to geophysical variables.

## CF 1.6 Checker (146/170):

- **lat is not allowed to have an axis attr as it is not a coordinate var**
  - Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html> for more information on coordinate variables.
  - According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **lon is not allowed to have an axis attr as it is not a coordinate var**
  - Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html> for more information on coordinate variables.
  - According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **time is not allowed to have an axis attr as it is not a coordinate var**
  - Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html> for more information on coordinate variables.
  - According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **z is not allowed to have an axis attr as it is not a coordinate var**
  - Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html> for more information on coordinate variables.
  - According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - This is an expected result and is an error in our templates. The variable z should not have axis attributes.
- **Conventions field is not "CF-1.6"**
  - Ignore this error as "Conventions: CF-1.6, ACDD-1.3"

- **Sal units are 0.001, standard\_name units should be 1e-3**
  - Ignore, 0.001 = 1e-3
- **Temp units are degree\_Celsius, standard\_name units should be K**
  - Ignore, degree\_Celsius is a UDUNIT and is sufficient in this context.
- **Units attribute required for trajectory variable**
  - Ignore, trajectory variable does not need to have units.
- **The trajectory dimension for the variable lat does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The trajectory dimension for the variable lon does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **Sal cell\_methods\_name all 3 failed "The name field does not appear in the allowable types.", "The name field does not match the dimension.", "The name field does not match the reserved words "interval", "area", or "comment"."**
  - "longitude: point latitude: point" should be "lon: point lat: point"
- **The trajectory dimension for the variable sal does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **Temp cell\_methods\_name all 3 failed "The name field does not appear in the allowable types.", "The name field does not match the dimension.", "The name field does not match the reserved words "interval", "area", or "comment"."**
  - "longitude: point latitude: point" should be "lon: point lat: point"
- **The trajectory dimension for the variable temp does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The trajectory dimension for the variable time does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)

- The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The trajectory dimension for the variable trajectory does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The trajectory dimension for the variable z does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - Technically, no coordinate variables exist in the file. (according to <http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html>)
  - The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.

## THREDDS:

### OPeNDAP Dataset Access Form:

- On a Linux command line, ran:  
`ncdump -h  
http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc`
- Functions as expected.

### HTTPServer:

- On a Linux command line, ran:  
`wget  
http://data.nodc.noaa.gov/thredds/fileServer/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc`  
`ncdump -h NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc`
- Functions as expected.

### WCS:

- Functions as expected.

### WMS:

- Functions as expected.

### NCML:

- Functions as expected.

## UDDC (44/46):

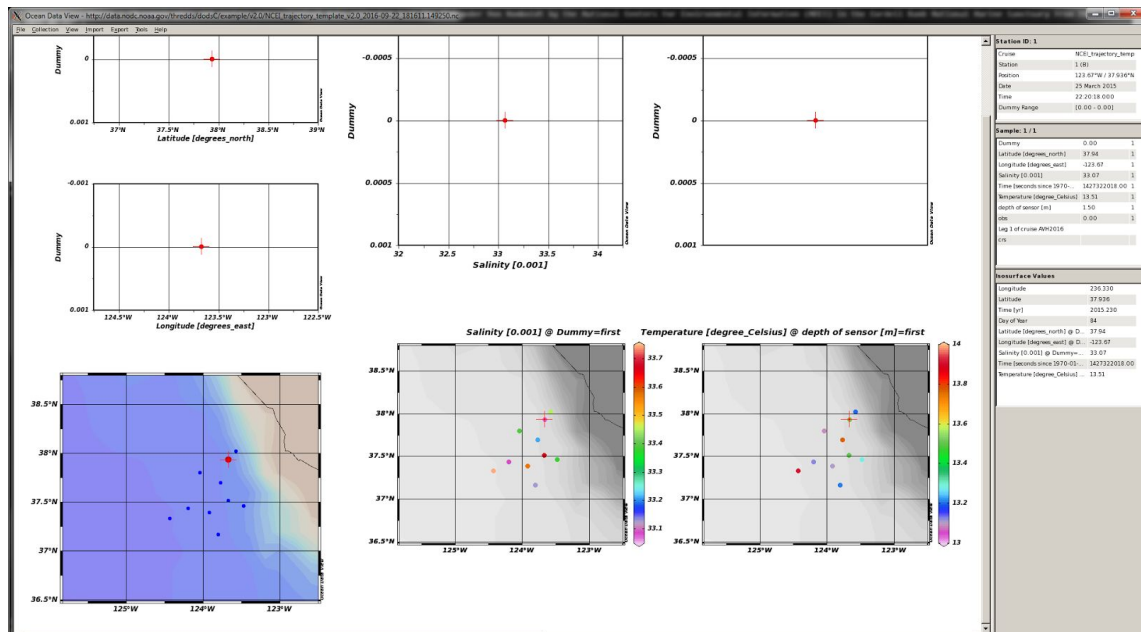
- **Missing Metadata\_Conventions**
  - Attribute has been deprecated in ACDD 1.3.
- **Missing acknowledgment**
  - Notice the spelling “acknowledgment” vs “acknowledgement”

## ISO:

- Functions as expected.

## Ocean Data View:

- **Open Remote:**
  - Url:  
[http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI\\_trajectory\\_template\\_v2.0\\_2016-09-22\\_181611.149250.nc](http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc)
  - Select ‘obs’, ‘trajectory’ as NetCDF Dimensions, ‘Use dummy variable’ as primary variable
  - Imports as expected.
- **Plot data:**
  - Have to define an Isosurface Variable for Temperature.
  - Plots as expected:



## Matlab (R2015a):

- **Importing the data:**



- Imports as expected:

```
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_
181611.149250.nc';
nc = ncinfo(url);
for i=1:length(nc.Variables) g=sprintf('%i ', nc.Variables(i).Size);
fprintf('%11s %s\n',nc.Variables(i).Name,g);
end

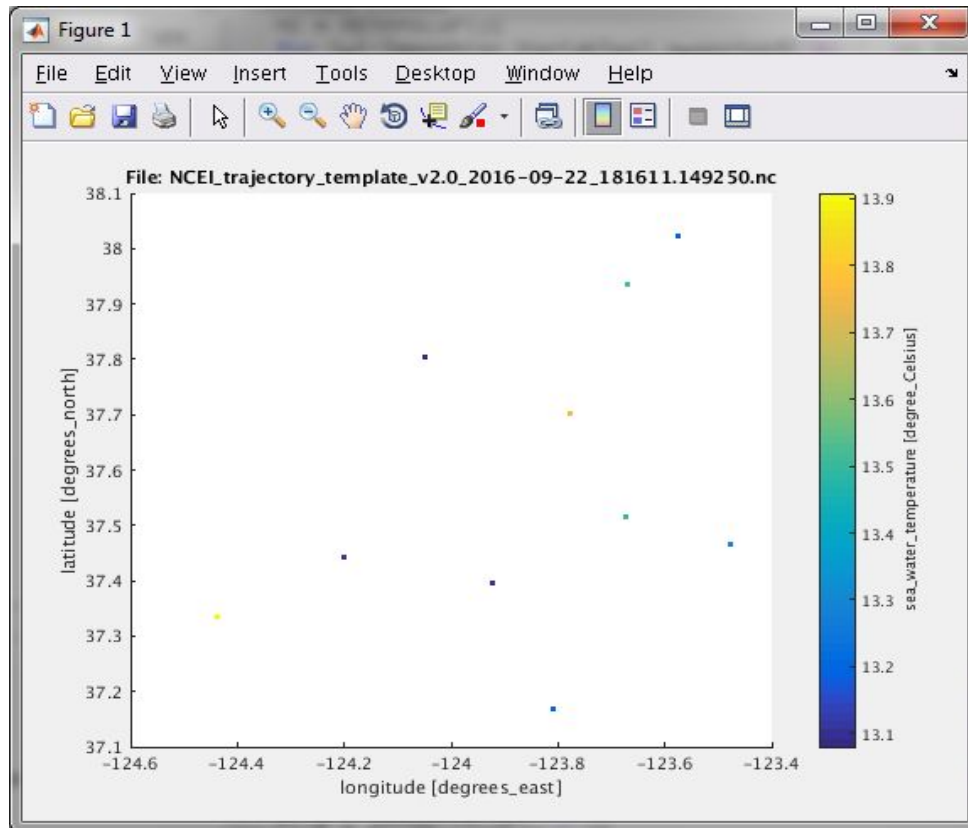
trajectory 1
    time 10 1
    lat 10 1
    lon 10 1
    z 10 1
    sal 10 1
    temp 10 1
instrument1 64
platform1 64
crs 1
```

- **Plotting the data:**

- Plots as expected:

```
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_
181611.149250.nc';
ncid = netcdf.open(url);
x1 = netcdf.getVar(ncid,3);
y1 = netcdf.getVar(ncid,2);
z1 = netcdf.getVar(ncid,6);

scatter(x1,y1,z1,z1,'filled')
c = colorbar();
xlabel(sprintf('%s [%s]',netcdf.getAtt(ncid,3,'standard_name'),...
    netcdf.getAtt(ncid,3,'units')), 'Interpreter','none');
ylabel(sprintf('%s [%s]',netcdf.getAtt(ncid,2,'standard_name')...
    ,netcdf.getAtt(ncid,2,'units')), 'Interpreter','none');
ylabel(c,sprintf('%s [%s]',netcdf.getAtt(ncid,6,'standard_name')...
    ,netcdf.getAtt(ncid,6,'units')), 'Interpreter','none');
file = strsplit(url,'/');
title(sprintf('File: %s',file{end}), 'Interpreter','none');
```



## Python 2.6.6:

- **Importing the data:**

- Imports as expected:

```
import netCDF4
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc'
f = netCDF4.Dataset(url,'r')
for v in f.variables:
    print '%11s %s %s' %(v, f.variables[v].dimensions, f.variables[v].shape)

trajectory (u'trajectory',) (1,)
time (u'trajectory', u'obs') (1, 10)
lat (u'trajectory', u'obs') (1, 10)
lon (u'trajectory', u'obs') (1, 10)
z (u'trajectory', u'obs') (1, 10)
sal (u'trajectory', u'obs') (1, 10)
temp (u'trajectory', u'obs') (1, 10)
instrument1 (u'maxStrlen64',) (64,)
platform1 (u'maxStrlen64',) (64,)
crs () ()
```

- **Plotting the data:**

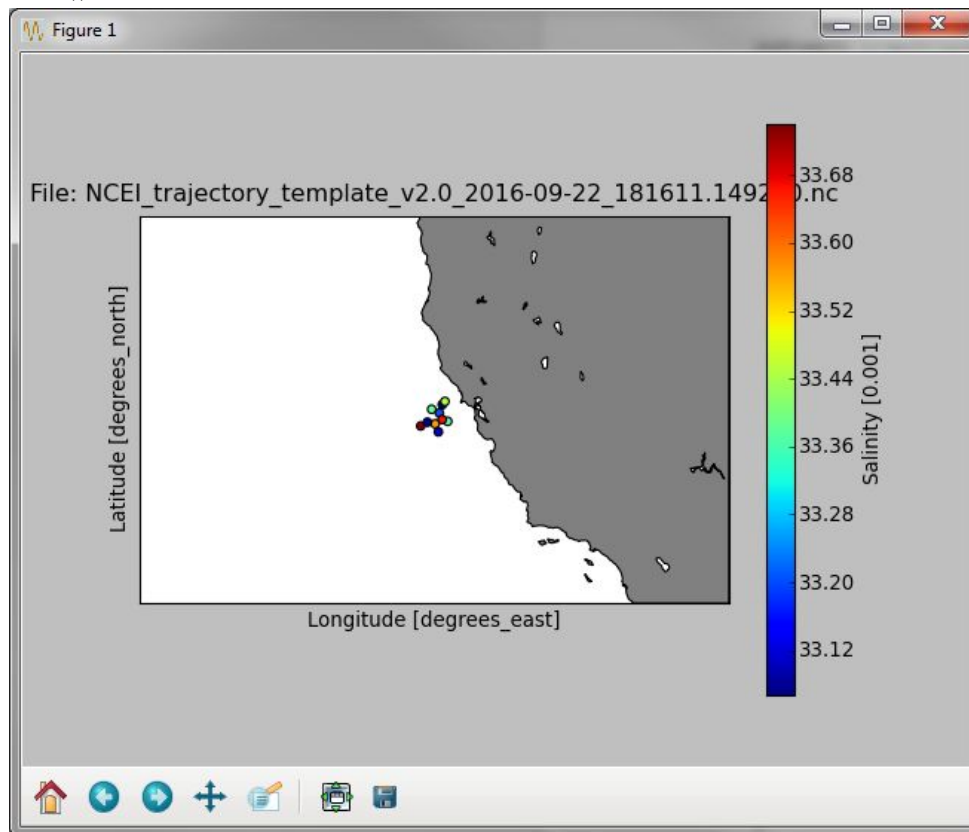
- Plots as expected:

```
import netCDF4
```

```
import numpy as np
import matplotlib.dates as mdates
import matplotlib.pyplot as plt
import datetime
from mpl_toolkits.basemap import Basemap

url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v2.0/NCEI_trajectory_template_v2.0_2016-09-22_181611.149250.nc'
f = netCDF4.Dataset(url, 'r')
var1_data = f.variables['lon'][:].flatten()
var2_data = f.variables['lat'][:].flatten()
var3_data = f.variables['sal'][:].flatten()

m = Basemap(projection='merc', llcrnrlat=np.min(var2_data)-5, urcnrlat=np.max(var2_data)+5, \
            llcrnrlon=np.min(var1_data)-10, urcnrlon=np.max(var1_data)+10, lat_ts=20, resolution='i')
m.drawcoastlines()
m.fillcontinents(color='gray')
x,y = m(var1_data, var2_data)
plt.scatter(x, y, c=var3_data)
cb = plt.colorbar()
cb.set_label('%s [%s]' %(f.variables['sal'].long_name, f.variables['sal'].units))
plt.xlabel('%s [%s]' %(f.variables['lon'].long_name, f.variables['lon'].units))
plt.ylabel('%s [%s]' %(f.variables['lat'].long_name, f.variables['lat'].units))
plt.title('File: %s' % url.split('/')[-1])
plt.show()
```



## Aggregation:

- Performed a 'joinExisting' aggregation on the 'trajectory' dimension.
- Aggregation worked as expected.